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RF-RMRS-97-023

Soil Sampling and Analysis Plan to Characterize Individual Hazardous Substance Sites (IHSS) 121 and 148 at Building 123

Rocky Flats Environmental Technology Site

Prepared by

Rocky Mountain Remediation Services, L. L. C.

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SOIL SAMPLING AND ANALYSIS PLAN TO CHARACTERIZE INDIVIDUAL HAZARDOUS SUBSTANCE SITES (IHSS) 121 AND 148 AT BUILDING 123

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ACRONYMS

Am ..... americium
Be ..... beryllium
BTEX ..... benzene, toluene, ethylbenzene, and xylenes
$C_2H_4O_2$ .... acetic acid
CERCLA ... Comprehensive Environmental Response, Compensation, and Liability Act
Cm ..... curium
DQO ..... Data Quality Objective
DOE ..... Department of Energy
EMD ..... Environmental Management Department
EPA ..... Environmental Protection Agency
ER ..... Environmental Restoration
FID ..... Flame Ionization Detector
FO ..... Field Operations
GIS ..... Geographical Information System
GPS ..... Global Positioning System
HNO_3 ..... nitric acid
HCl ..... hydrochloric acid
$HClO_4$ ..... perchloric acid
HF ..... hydrofluoric acid
HPGe ..... high-purity germanium
H_2SO_4 ..... sulfuric acid
IAG ..... Interagency Agreement
IHSS ..... Individual Hazardous Substance Site
MCL ..... maximum concentration limits
NaOH ..... sodium hydroxide
NH_4OH .... ammonium hydroxide
OPWL ..... Original Process Waste Line
OU ..... Operable Unit
PAM ..... Proposed Action Memorandum
PARCC .... precision, accuracy, representativeness, completeness, and comparability
PCB ..... polychlorinated biphenyl
PCE ..... tetrachloroethene
PID ..... Photo Ionization Detector
PRG ..... Preliminary Remediation Goal
Pu ..... plutonium
QA/QC .... Quality Assurance/Quality Control
QAPD ..... Quality Assurance Program Description
RCRA ..... Resource Conservation and Recovery Act
RFCA ..... Rocky Flats Cleanup Agreement
RFEDS .... Rocky Flats Database System
RFETS ..... Rocky Flats Environmental Technology Site
RFI/RI ..... RCRA Facility Investigation/ Remedial Investigation
RMRS ..... Rocky Mountain Remediation Services
SOPs ..... Standard Operating Procedures
SAP ..... Sampling and Analysis Plan
SAR ..... Sampling and Analysis Report
TAL ..... Target Analyte List
TCFM ..... trichlorofluoromethane
TCL ..... Target Compound List
TOC ..... total organic carbon
U ..... uranium
UBC ..... under building contamination
VOC ..... volatile organic compound

LIST OF APPLICABLE STANDARD OPERATING PROCEDURES (SOPs)

Identification Number	Procedure Title
2-G18-ER-ADM-17.01	*Records Capture and Transmittal*
2-G32-ER-ADM-08.02	*Evaluation of ERM Data for Usability in Final Reports*
2-S47-ER-ADM-05.15	*Use of Field Logbooks and Forms*
5-21000-OPS-FO.03	*General Equipment Decontamination*
5-21000-OPS-FO.06	*Handling of Personal Protective Equipment*
5-21000-OPS-FO.13	*Containerization, Preserving, Handling and Shipping of Soil and Water Samples*
5-21000-OPS-FO.15	*Photoionization Detectors and Flame Ionization Detectors*
5-21000-ER-OPS-GT.01	*Logging Alluvial and Bedrock Material*
5-21000-ER-OPS-GT.39	*Push Subsurface Soil Sampling*
4-U50-REP-1006	*Radiological Characterization of Bulk or Volume Materials*

SOIL SAMPLING AND ANALYSIS PLAN TO CHARACTERIZE INDIVIDUAL HAZARDOUS SUBSTANCE SITES (IHSS) 121 AND 148 AT BUILDING 123

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide a Sampling and Analysis Plan (SAP) for the characterization of soils underlying and surrounding Building 123, with respect to the Rocky Flats Cleanup Agreement (RFCA) and pursuant to the Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The goal of the field investigation is to provide the data necessary to support the decontamination and demolition of Building 123 and fulfill criteria defined by the *Proposed Action Memorandum (PAM) for the Decommissioning of Building 123* (RMRS 1997a).

The objective of the SAP is to define the specific data needs, sampling and analysis requirements, data handling procedures, and associated Quality Assurance/Quality Control (QA/QC) requirements for this project. All work will be performed in accordance with the RMRS Quality Assurance Program Description (QAPD) (RMRS 1997b).

1.1 Background

Building 123 is located on Central Avenue between Third and Fourth Streets at the Rocky Flats Environmental Technology Site (RFETS). The Building 123 Area encompasses overlapping Individual Hazardous Substance Sites (IHSSs) 121 and 148 and a portion of RCRA Unit 40 (Figure 1.1).

1.1.1 RCRA Unit 40

The Building 123 area encompasses a portion of RCRA Unit 40, the plant-wide process waste system, a network of tanks and underground and overhead pipelines constructed to transport and temporarily store process wastes from point of origin to on-site treatment and discharge points. RCRA Unit 40 includes all overhead and underground and process waste lines in and around Building 123. No other RCRA unit exists in the Building 123 area.

1.1.2 IHSS 121

IHSS 121 consists of RCRA Unit 40 underground Original Process Waste Lines (OPWLs) P-1, P-2, and P-3, which were designated in the *Final Phase I RCRA Facility Investigation/Remedial Investigation (RFI/RI) Work Plan For Operable Unit 9* (DOE 1992a). The OPWL system constitutes Operable Unit No.9 (OU9) and RCRA Unit 40, the plant-wide process waste system comprised of tank and underground pipelines constructed to transport and temporarily store process wastes from point of origin to on-site treatment and discharge points.

All process waste generated from 1952 to 1968 was transferred from Building 123 to Building 441 through line P-2, which ran below the west side of the east wing before exiting at the southeast corner of the building. In 1968 the southeast wing was extended about fifty (50) feet to the south. Prior to the building addition, two manholes (MH-2 and MH-3, Figure 1.1) were constructed and the line was extended south to MH-2, then east to MH-3, and north to MH-4, before assuming the original path at P-2. The extension was designated as P-3. One manhole was abandoned and covered by the building addition. In 1972 a west wing was constructed, extending south from the

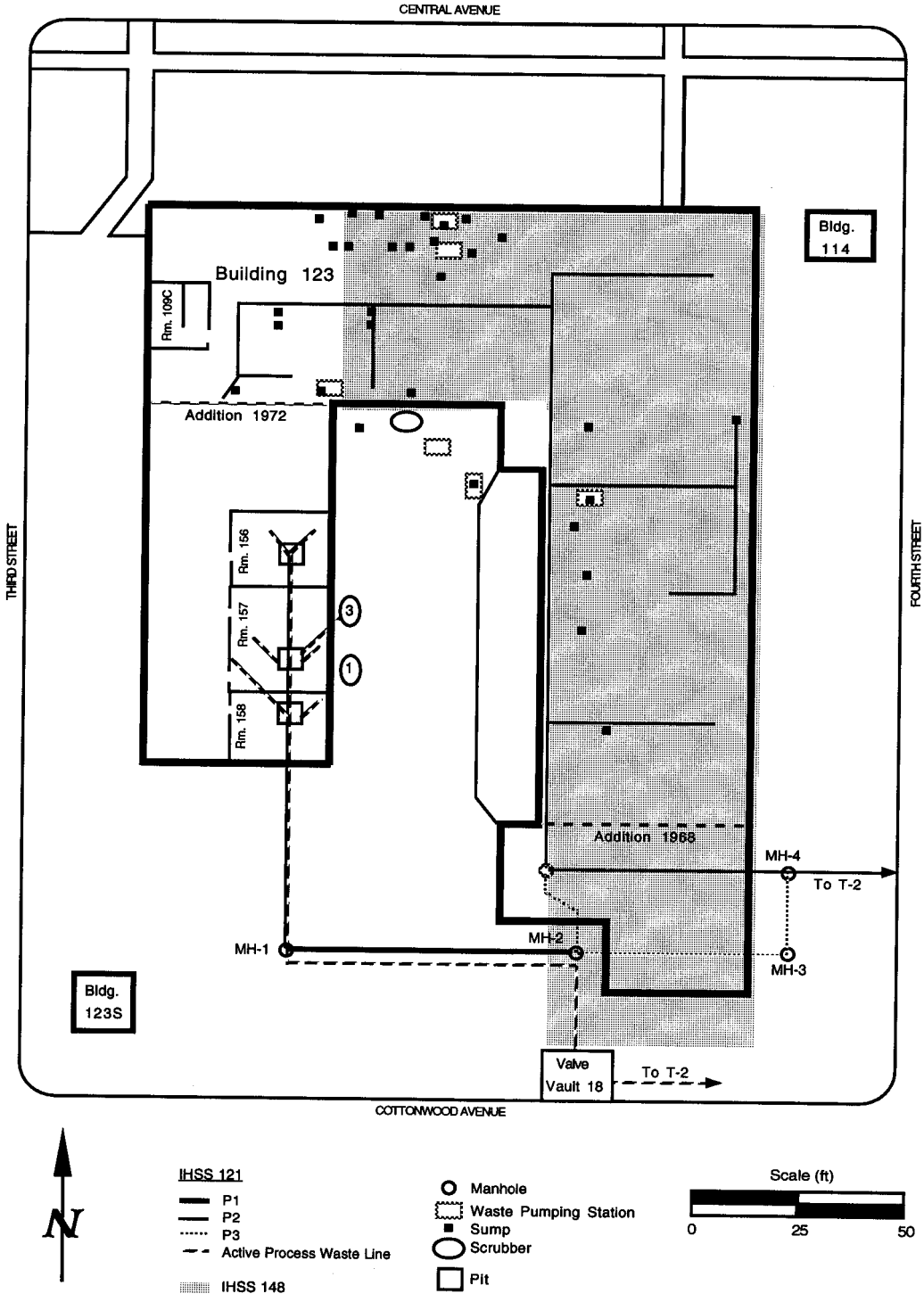

Figure 1.1 Location of Building 123 and Associated IHSSs 121 and 148

northwest corner of the original building. Prior to construction of the wing, line P-1 was installed to transfer waste to manhole MH-1, then east to a junction with P-3 at MH-2 (Figure 1.1). The lines transferred the following process waste from Building 123:

- Acids: nitric acid (HNO_3), hydrofluoric acid (HF), sulfuric acid (H_2SO_4), hydrochloric acid (HCl), acetic acid ($C_2H_4O_2$), and perchloric acid ($HClO_4$);
- Bases: ammonium hydroxide (NH_4OH) and sodium hydroxide (NaOH);
- Solvents: acetone, alcohols, cyclohexane, toluene, xylenes, triisooctomine, and ether;
- Radionuclides: various isotopes of plutonium (Pu), americium (Am), uranium (U), and curium (Cm);
- Metals: beryllium (Be) (trace amounts); and
- Others: ammonium thiocyanate, ethylene glycol, and possible trace amounts of polychlorinated biphenyls (PCBs) (DOE 1992a).

In 1982 P-2 and P-3 were abandoned and plugged with cement. In 1989 the process waste transfer system was upgraded, including removal of the east-west section of P-1 between MH-2 and MH-3. The north-south section of P-1 between Building 123 and MH-1 was converted to the new process system. Three large, interconnected concrete sump pit areas were installed in Rooms 156, 157, and 158 to accommodate process waste system backup. Pipe was installed connecting MH-1 to Valve Vault 18 (Figure 1.1).

Currently, all process waste throughout Building 123 is collected in floor sumps. Each sump collects and temporarily stores liquid waste which is then pumped through overhead lines into a main floor sump in Room 158. The waste is then gravity-fed through P-1 to Valve Vault 18, then to underground Tank T-2 (Tank 428) at Building 441, and finally to Building 374 for treatment (Figure 1.1).

Unconfirmed reports of contaminant spills have been indicated in interviews with building employees. In the late 1960's or early 1970's a cesium-contaminated liquid was spilled on the concrete floor in Room 109C (Figure 1.1). The floor was immediately sealed to immobilize the contamination. In the 1970's, groundwater filled the three sump pits in Rooms 156, 157, and 158, compounded with a backup in P-1. The pits were pumped out and the concrete properly sealed. In the 1980's, such backups occassionally forced process liquid back through Scrubbers 1 and 3 (Figure 1.1), effecting small spills. No documentation could be obtained to confirm such incidents.

1.1.3 IHSS 148

A detailed characterization of OU13 was conducted from September 1993 to February 1995 as part of a Phase I RCRA RFI/RI. The characterization included high-purity germanium (HPGe) surveys, vertical soil profiles, surface soil sampling and soil gas surveys. The investigation identified an area of reported small spills of nitrate-bearing wastes along the east side of Building 123 and a potential for soil contamination beneath the building due to possible leaks in OPWL P-2. The area was established as IHSS 148 and detailed in the *Final Phase I RFI/RI Work Plan for Operable Unit 13* (DOE 1992b). The area has also been identified as Under Building Contamination (UBC) 123 in the RFETS *Historical Release Report* (HRR, DOE 1992c).

Thirty-four (34) analytes were detected in the surface soil survey, including twenty-six (26) inorganic compounds and eight (8) radionuclides. Eleven (11) analytes exceeded background limits at a minimum of one sample location throughout IHSS 148. Constituents that exceeded minimum detection levels or activities are included in Table 1.1.

Table 1.1 Constituents Detected Above Minimum Detection Levels or Activities in Soil Samples Collected During Surface Soil Survey at IHSS 148

Constituents Detected Above Minimum Detection Levels or Activities	Preliminary Remediation Goal (PRG)[a]	Background Limits [a]	Maximum Concentration
Chromium	1,370 mg/kg	24.8 mg/kg	95.6 mg/kg
Cobalt	0.00 mg/kg[b]	24.8 mg/kg	28.7 mg/kg
Copper	11,000 mg/kg	27.3 mg/kg	43.4 mg/kg
Lead	0.00 mg/kg	61.4 mg/kg	165 mg kg
Nickel	5,490 mg/kg	26.9 mg/kg	52.4 mg/kg
Strontium	165,000 mg/kg	90.1 mg/kg	94.7 mg/kg
Zinc	82,300 mg/kg	86.6 mg/kg	1,220 mg/kg
Americium-241	2.37 pCi/g	0.0634 pCi/g	0.197 ± 0.032 pCi/g
Plutonium-239/-240	3.42 pCi/g	0.1321 pCi/g	0.169 ± 0.04 pCi/g
Uranium-233/-234	44.7 pCi/g	1.769 pCi/g	2.04 ± 0.396 pCi/g
Uranium-238	46.0 pCi/g	1.912 pCi/g	2.14 ± 0.309 pCi/g

[a] DOE 1992b. Non-radioactive values were established by the IAG and were current at the time of the report. Radioactivity action levels have since been revised as part of RFCA.
[b] Constituent does not have an established PRG.

The soil-gas survey was conducted on a 25-foot grid in accordance with the work plan. Sixty-four (64) soil-gas locations were sampled during the survey. Thirteen (13) samples contained volatile organic compound (VOC) levels in excess of the 1 µg/ L method detection limit. Benzene, toluene, ethylbenzene, and xylene (BTEX) fuel constituents were detected in samples collected from the perimeter of Building 123 and within the west and east wings of the building. Trichlorofluoromethane (TCFM) was detected in nine samples distributed throughout the IHSS 148 area at levels up to 2.6 µg/ L. Tetrachloroethene (PCE) was detected at 1.5 µg/ L in a sample collected to the east of Building 123. The presence of organic extraction constituents is consistent with unconfirmed reports that such liquids used in radionuclide analyses were occasionally disposed onto the soil surface outside of Building 123 and allowed to evaporate. Analyses results indicate that subsurface infiltration precluded full evaporation.

The HRR also indicated a potential for soil contamination from sources other than Building 123 and associated OPWLs.

1.2 Geology

The local geologic setting includes an industrial area that has been gradually developed. The natural soils have been disturbed and replaced by fill during installation of the OPWLs and covered by pavement and structures including Building 123. The soils, fill, pavement, and structures are underlain by Rocky Flats Alluvium which averages about 38 feet in thickness and is composed of poorly- to moderately-sorted clay, silt, sand, and gravel. The Cretaceous Arapahoe Formation underlies the surficial material and is mainly claystone and silty claystone with sandstone bodies present. Groundwater exists below the site at a depth of approximately 12-17 feet and flows in a generally eastward direction.

2.0 SAMPLING RATIONALE

Historical information detailed in Section 1.1 provides general indications of the types of compounds anticipated at each IHSS, and was used to develop a systematic sampling strategy for this investigation. The sampling rationale is based on a combination of historical data and recommendations by K-H Statistical Applications (memo attached). Preliminary sampling will be restricted to soils underlying and surrounding Building 123. Additional characterization will be

contingent upon initial sample analyses results.

The following conditions were considered in the development of the sampling strategy:

- the operating history of Building 123 suggests that contaminant may have been released into the environment;
- the physical and chemical properties of the contaminant suggest a chronic presence if released into the environment; and
- historical data indicate the presence of contaminants in quantities above the maximum background concentrations defined by Procedure 4-U50-REP-1006 *Radiological Characterization of Bulk or Volume Materials* and the *Background Geochemical Characterization Report* (DOE 1993).

The conceptual models of contaminant migration involve percolation downward through the vadose zone (generally less than 10 feet thick) to the water table and then in the direction of groundwater flow. Contaminants may volatilize, biodegrade, or radioactively decay before reaching the shallowest groundwater zone. Contaminant concentrations are also reduced by dispersion during migration through the porous Rocky Flats Alluvium. Paved portions of the Building 123 area provide an additional impedence to contaminant migration, as precipitation is diverted to the storm water drainage system instead of percolating through the ground surface.

Selection of contaminants of concern was based upon historical process data and analytical data.

3.0 DATA QUALITY OBJECTIVES (DQOs)

EPA has established a process to Superfund decision-making as the basis for developing DQOs. DQOs are designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended application. The data must also facilitate appropriate remedial measures for mitigating risk. Data requirements to support this project were developed using criteria established in *Guidance for the Data Quality Objective Process*, QA/G-4 (EPA 1994). The DQO process contains seven sequential steps.

State the Problem
Identify the Decision
Identify the Inputs to the Decision
Define the Study Boundaries
Develop a Decision Rule
Specify Tolerable Limits on Decision Errors
Optimize the Design

The DQO process was implemented and the rationale for each step is outlined below.

State the Problem

The problem is to determine the building status in terms of the presence or absence of hazardous and/or radioactive constituents.

Identify the Decision

Specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the proper decommissioning and demolition of Building 123.

Identify the Inputs to the Decision

The following information will be required to resolve the decision:

Historical Information
Media Sampling (as outlined in Section 4.0)

Define the Study Boundaries

The methodology contained in this document applies to all buildings and areas associated with the Building 123 cluster.

Develop a Decision Rule

Data collected during this project will be evaluated in accordance with all applicable regulatory requirements. If any of these requirements are not met, alternative actions such as decontamination and remediation may be necessary.

Specify Tolerable Limits on Decision Errors

The error rates for the data collected during this study are incorporated into the detection limits for the analysis parameters. Therefore, it has been determined the these limits are acceptable for the DQOs.

Optimize the Design

The data collection design will be optimized by utilizing Characterization Instructions and Decommissioning Characterization Protocols that will be developed for this project.

Data will be analyzed with respect to surface and subsurface soil action levels specified in the RFCA. The action levels are intended to prevent contamination of surface water and groundwater by applying action levels to soils and are based on maximum concentration limits (MCLs) and applied using a two-tiered approach. Tier I action levels are 100 x MCLs and are designed to identify sources of surface and subsurface soil contamination, in which soil is removed from the source through accelerated actions. Tier II action levels consist of MCLs and are designed to protect surface water and groundwater through accelerated actions managed on a case-by-case basis.

All data will be compared to Tier II action levels. If required, the data will also be the basis for corrective measure design.

4.0 SAMPLING ACTIVITIES

4.1 Sample Location and Frequency

The sampling event focuses on the soils underlying and surrounding Building 123 as indicated in Figure 4.1. Subsurface soils will be sampled to a total depth of six (6) feet as described in Section 4.3., as historical data indicates that the presence of contaminants below this depth is unlikely (DOE 1992b). Evaluation of sample analyses results may indicate if the potential exists for groundwater contamination.

Fifty-seven (57) locations will be sampled: seven (7) will be collected from the building slab, twenty-seven (27) will be located underneath the Building foundation, and twenty-three (23) will be located in areas surrounding Building 123 (Figure 4.1). The locations were determined with respect to underground OPWLs, paved and unpaved areas, and recommendations by K-H Statistical Applications. The investigation will focus on these areas:

- unpaved areas along the east side of Building 123, to further characterize potential areas of

volatile organic constituent contamination;

- underground OPWLs beneath and to the south of Building 123;
- points at which the overhead waste process lines enter the subsurface at the south end of the west wing of Building 123;
- areas of reported surface spills with Building 123
- locations of process waste sumps, waste pumping stations, and OPWL junctions and elbows; and
- a sampling grid at approximately 50-foot intervals to characterize the remainder of the Building 123 area. According to *Final Phase I RFI/RI Work Plan for Operable Unit 13, 100 Area* (DOE 1992) and personnel interviews, no contaminant spills or leaks have been reported in these areas, thus a uniform sampling grid is appropriate.

One soil sample will be collected at each location. Figure 4.1 indicates depths at which each sample will be collected. Locations outside of Building 123 will be sampled at the total depth of six (6) feet. Locations within the Building 123 perimeter near waste pumping stations, sumps, and junctions will also be sampled at a depth of six (6) feet, as building as-built drawings indicate that